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Service Manual

Tektronix

P7260
6 GHz 5X/25X Active Probe

071-1113-00

Warning
The servicing instructions are for use by qualified personnel only. To avoid personal injury, do not perform any servicing unless you are qualified to do so. Refer to all safety summaries prior to performing service.

www.tektronix.com

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Tektronix, Inc., P.O. Box 500, Beaverton, OR 97077

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General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it. To avoid potential hazards, use this product only as specified.

To Avoid Fire or Personal Injury

Connect and Disconnect Properly. Connect the probe output to the measurement instrument before connecting the probe to the circuit under test. Disconnect the probe input and the probe ground from the circuit under test before disconnecting the probe from the measurement instrument.

Observe All Terminal Ratings. To avoid fire or shock hazard, observe all ratings and markings on the product. Consult the product manual for further ratings information before making connections to the product.

Do Not Operate Without Covers. Do not operate this product with covers or panels removed.

Do Not Operate With Suspected Failures. If you suspect there is damage to this product, have it inspected by qualified service personnel.

Do Not Operate in Wet/Damp Conditions.

Do Not Operate in an Explosive Atmosphere.

Keep Product Surfaces Clean and Dry.

Symbols and Terms

Terms in this Manual. These terms may appear in this manual:

WARNING. *Warning statements identify conditions or practices that could result in injury or loss of life.*

CAUTION. *Caution statements identify conditions or practices that could result in damage to this product or other property.*

Terms on the Product. These terms may appear on the product:

DANGER indicates an injury hazard immediately accessible as you read the marking.

WARNING indicates an injury hazard not immediately accessible as you read the marking.

CAUTION indicates a hazard to property including the product.

Symbols on the Product. The following symbols may appear on the product:

CAUTION
Refer to Manual

Service Safety Summary

Only qualified personnel should perform service procedures. Read this *Service Safety Summary* and the *General Safety Summary* before performing any service procedures.

Do Not Service Alone. Do not perform internal service or adjustments of this product unless another person capable of rendering first aid and resuscitation is present.

Preface

This is the service manual for the P7260 6 GHz Active Probe. Read this preface to learn how this manual is structured and where you can find other information related to servicing this product.

This manual is available as a printable .pdf file on our website at www.tektronix.com. Select the *Software and Drivers* link located on the home page.

Manual Structure

This manual contains two sections—*Description* and *Performance Verification* and is intended to be used by qualified service personnel. Replaceable parts are limited to accessories and adapters and are described in the User Manual that is shipped with the probe.

Be sure to read the introductions to all procedures. These introductions provide important information needed to do the service correctly, safely, and efficiently.

Related Documentation

The probe is shipped with the following manual:

- *P7260 6 GHz 5X/25X Active Probe User Manual* (Tektronix part number 071-0922-XX)

Contacting Tektronix

Phone	1-800-833-9200*
Address	Tektronix, Inc. Department or name (if known) 14200 SW Karl Braun Drive P.O. Box 500 Beaverton, OR 97077 USA
Web site	www.tektronix.com
Sales support	1-800-833-9200, select option 1*
Service support	1-800-833-9200, select option 2*
Technical support	Email: support@tektronix.com 1-800-833-9200, select option 3* 6:00 a.m. – 5:00 p.m. Pacific time

*** This phone number is toll free in North America. After office hours, please leave a voice mail message.**
Outside North America, contact a Tektronix sales office or distributor; see the Tektronix web site for a list of offices.

Description

This document describes the *Performance Verification* procedures for the P7260 6 GHz 5X/25X Active Probe. There are no user-replaceable parts inside the probe. If the probe fails the performance verification procedure, contact your Tektronix service center.

Performance Verification

Use the performance verification procedures to verify the warranted specifications of the P7260 probe. The recommended calibration interval is one year.

The performance verification procedures check the following specifications at 5X and 25X attenuation:

- Output Zero
- DC Gain Accuracy
- Small Signal Risetime

Equipment Required

Refer to Table 1 for the equipment required to perform the service procedures.

Table 1: Equipment required for performance verification

Item description	Performance requirement	Recommended example
Sampling Oscilloscope	≥12.5 GHz bandwidth	Tektronix TDS8000
Sampling module (head), with extension cable	≥12.5 GHz bandwidth	Tektronix 80E0X with 012-1568-00 cable
Oscilloscope	TekConnect Interface	Tektronix TDS6604
TekConnect calibration adapter	TekConnect Interface	067-0422-XX
Calibration Step Generator	250 mV step, ≤30 ps rise time	067-1338-XX
Adapter	TekConnect-to-SMA	TCA-SMA
Adapter	Fixture, Probe Calibration	067-1456-XX
DC Power Supply	1 VDC at 1 mA	Tektronix PS280
DMM (2) with leads	0.05% accuracy, 0.1 mV resolution	Fluke 87 or equivalent
Feedthrough Termination	50 Ω ±0.05 Ω	011-0129-XX
BNC-to-BNC coaxial cable	50 Ω coaxial cable	012-0057-01
Coaxial cable	Male-to-Male SMA	012-0649-XX
Adapter	SMA Male-to-Male	015-1011-XX
Adapter	SMA Female-to-Female	015-1012-XX
Adapter	SMA Male-to-BNC Female	015-1018-XX
Adapter	BNC Female-to-Dual Banana	103-0090-XX
Adapter	Y-lead adapter	196-3434-XX
Adapter	Square-Pin adapter	016-1910-XX
Adapters (2)	SMT KlipChip adapter	206-0364-XX
SMA torque wrench	5/16-in, 7 in-lb.	
SMA adapter wrench	7/32-in	
Test leads (2)	Banana Plug to Banana Plug, Red	012-0031-XX
Test leads (2)	Banana Plug to Banana Plug, Black	012-0039-XX

Special Adapters Required

Some of the adapters listed in Table 1 are custom-made and available only from Tektronix. The adapters are described on the following pages.

TekConnect-to-SMA Adapter

The TekConnect-to-SMA Adapter, Tektronix part number TCA-SMA, allows signals from an SMA cable or probe to be connected to a TekConnect input. See Figure 1. Connect and disconnect the adapter the same way as you do the P7260 Probe.

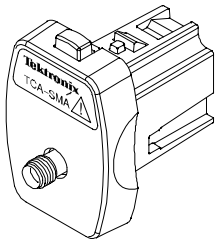


Figure 1: TekConnect-to-SMA adapter

Probe Calibration Fixture

The probe calibration fixture, Tektronix part number 015-1456-XX, provides a low-noise method for connecting the P7260 to signals present on SMA cables. The adapter has a test point for the probe and two SMA connectors. A 50 Ω termination is included with the adapter, and is connected to the SMA connector nearest the probe test point to minimize reflections. Connect the cable from the test circuit to the other SMA connector. This fixture includes a probe holder that works to securely hold the probe on the test point. See Figure 2 on page 4.

***NOTE**. When taking measurements, do not touch the probe tip adapter. Measurement accuracy is degraded when the probe tip adapter is handled.*

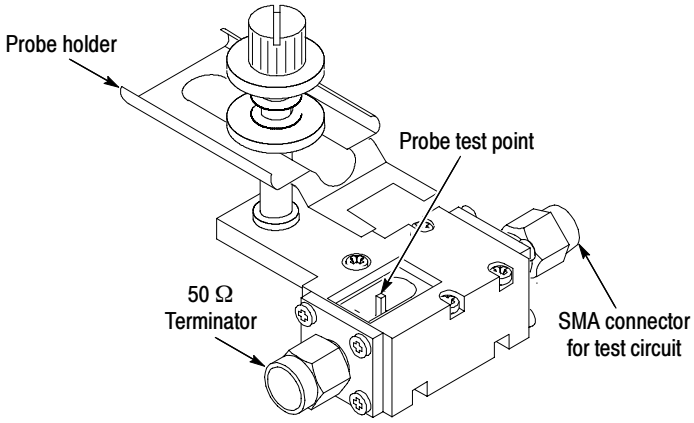


Figure 2: Probe calibration fixture

TekConnect Interface Calibration Adapter

The TekConnect Interface Calibration Adapter, Tektronix part number 067-0422-XX, connects between the host instrument and the probe under test, and provides connectors for probe signal and offset voltage measurements. See Figure 3.

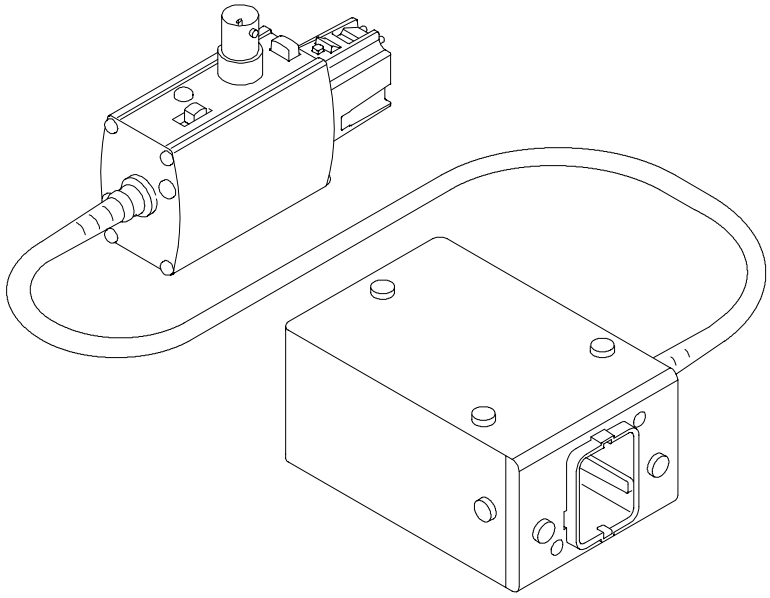
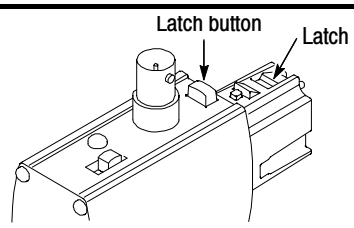
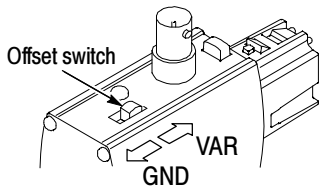
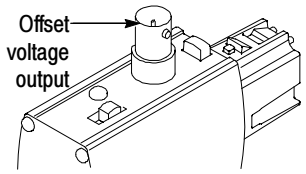
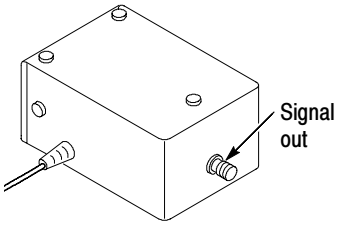


Figure 3: TekConnect Interface Calibration Adapter

When the adapter is connected to the oscilloscope, the adapter is identified as a valid calibration device. However, additional power supplies necessary to power the probe are not enabled until a TekConnect probe is connected to the adapter and identified by the oscilloscope. When a probe is detected through the adapter, the Volts/division readout on the oscilloscope displays ##.

Refer to Table 2 on page 6 for features of the calibration adapter.

Table 2: TekConnect Interface Calibration Adapter features

Feature	Description
	**Latch button.** The spring-loaded latch mechanically retains the adapter to the oscilloscope. To release the adapter, grasp the adapter housing, depress the latch button, and pull the adapter straight out of the oscilloscope.
	**Offset output select switch.** The offset output switch selects between ground and the offset voltage level from the oscilloscope. Leave the switch in the ground position for the performance verification procedures. Move the switch to the variable position for the adjustment procedures.
	**Offset voltage.** The offset voltage of the probe is accessed through the BNC connector. Measure the offset voltage using a DVM, BNC coaxial cable, and BNC-to-dual-banana jack.
	**Signal out.** The SMA connector on the rear of the box allows for direct monitoring of the probe signal.

Performance Verification

Use the following procedures to verify the warranted specifications of the P7260 probe. Before beginning these procedures, refer to page 18, photocopy the test record, and use it to record the performance test results. The recommended calibration interval is one year.

These procedures test the following specifications at 5X and 25X:

- Output Zero
- DC Gain Accuracy
- Small Signal Risetime

Electrostatic Discharge (ESD). The P7260 is sensitive to electrostatic discharge. To prevent electrostatic damage when handling the probe, always wear an anti-static wrist strap (provided with your probe), and plug the wrist strap into the ground terminal available on your host instrument or static-approved workstation.

Equipment Setup

Use this procedure to set up the equipment before testing the probe. Refer to the list of required equipment in Table 1 on page 2.

1. Connect the probe calibration adapter to the oscilloscope.
2. Connect the probe to the probe calibration adapter.
3. Turn on the oscilloscope, and enable the channel.
4. Verify that the Volts/division readout on the oscilloscope channel displays ## (the oscilloscope recognizes the probe through the adapter).
5. Set the multimeter to read DC volts.
6. Allow 30 minutes for the equipment to warm up.

***NOTE**. To avoid corrupted test results, do not disconnect the probe under test or the probe calibration adapter until you have completed the service procedures. If the probe or adapter are disconnected before completing the procedures, you must reconnect the probe and adapter, and exit and restart the application.*

Using the Performance Verification Application

While the test equipment is warming up, load the TekConnect Performance Verification application onto your host instrument, or verify that you already have the latest version of the application on your host instrument.

1. Access the Tektronix Website at www.Tektronix.com, and then download the application:
   a. On the Tektronix website home page, select the Software & Drivers link.
   b. Select the Accessories link, and then click on TekConnectAdjustSetup.exe
2. On the host instrument, open the file TekConnectAdjustSetup.exe. To install the application, follow the instructions that the Install Shield Wizard provides.
3. When installation is complete, go to: Start→Programs→Tektronix→TekConnect Adjust. Then open TekConnectAdjustSetup.exe.
4. After the application opens, the TekConnect Adjustment Application dialog box appears (see Figure 4).

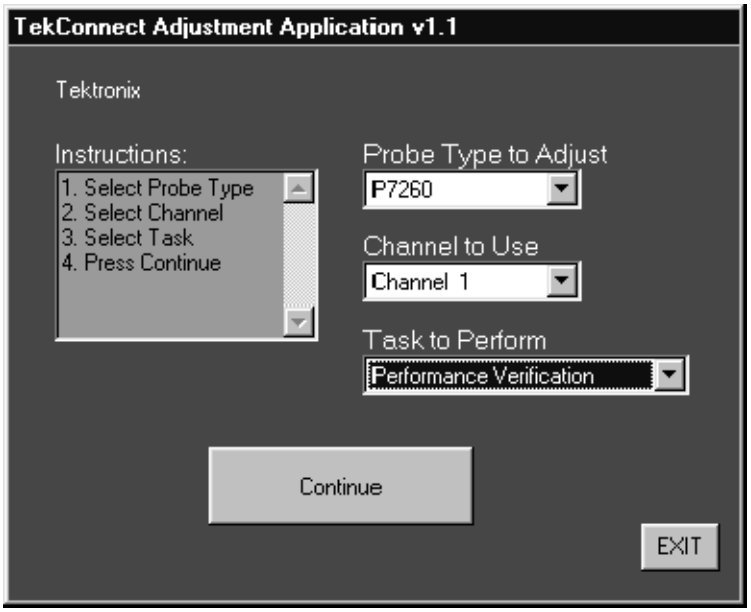


Figure 4: TekConnect Adjustment Application dialog box

5. Make the following selections in the TekConnect Adjustment Application dialog box:
   a. From the Probe Type to Adjust list, select P7260.
   b. From the Channel to Use list, select the oscilloscope channel where the probe is connected.
   c. From the Task to Perform list, select Performance Verification.
6. Click the Continue button. The P7260 Performance Verification dialog box appears (see Figure 5 on page 9).

***NOTE**. An error message appears if one of the following conditions exists:*

- *A probe is not connected to the adapter.*
- *A probe model other than a P7260 is connected to the adapter.*
- *The P7260 that is connected to the adapter is defective (unable to properly communicate with the adapter).*

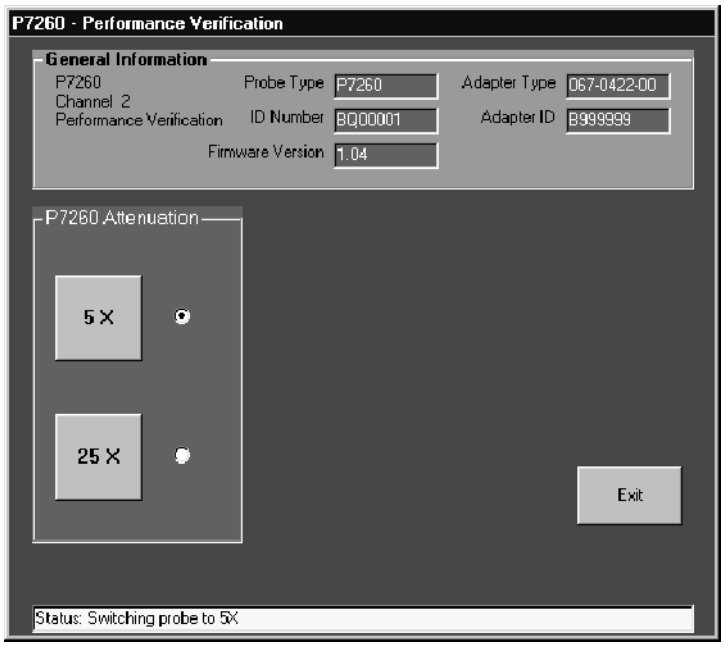


Figure 5: TekConnect Performance Verification dialog box

Changing Attenuation for Performance Verification

Use the Performance Verification application to change the attenuation setting of the P7260 while performing the tests. Keep the Performance Verification dialog box open while you are performing the Performance Verification procedures.

To change the attenuation setting of the probe, click on the button of the attenuation setting you want to use.

To close the P7260 Performance Verification screen, click the Exit button. To close the TekConnect Adjustment application, click Exit again.

Output Zero

Use this procedure to verify the probe output zero. Perform this test at the 5X attenuation setting of the probe, and then test again at the 25X attenuation setting. Use the same test equipment setup for both tests.

1. Connect the test equipment as shown in Figure 6, below. Short the probe leads together by connecting the KlipChip adapters together.

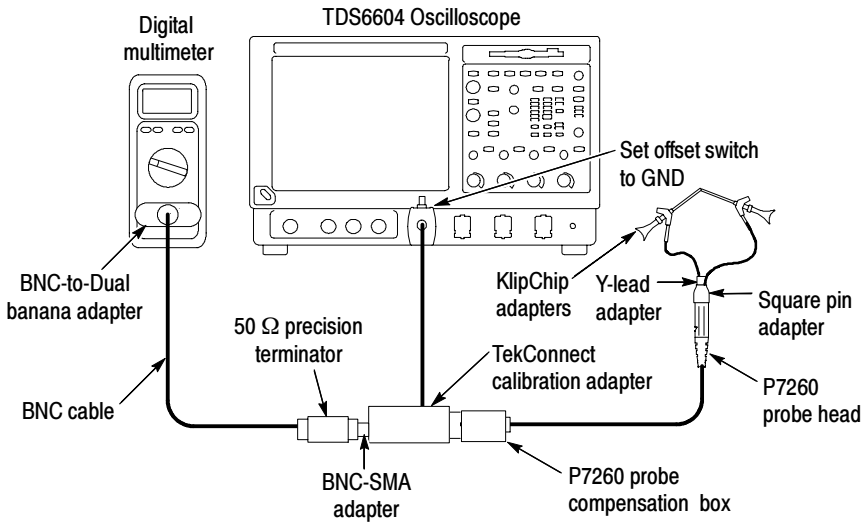


Figure 6: Setup for output zero

2. For each P7260 attenuation setting (5X and 25X), repeat steps 3 through 5.

NOTE*. To change attenuation settings while performing verification checks, use the radio buttons on the* TekConnect Performance Verification *dialog box (see page 10 for instructions).*

3. Set the offset switch on the calibration adapter to GND.

NOTE*. Leave the offset switch in the ground position for all of the performance verification checks.*

4. Ground the probe tip by connecting the probe tip to the probe ground socket. (Connecting two KlipChip adapters together is recommended.)

5. Observe the multimeter display, and record the results on the test record. For both 5X and 25X attenuation, the DC level should be 0.000 V ±10 mV.

DC Gain Accuracy

Perform this test at the 5X attenuation setting of the probe, and then test again at the 25X attenuation setting. Use the same test equipment setup for both tests.

1. Disconnect the KlipChip adapters, and connect the probe input to the DC source, as shown in Figure 7, below. Monitor the source voltage with the digital multimeter DMM #1.

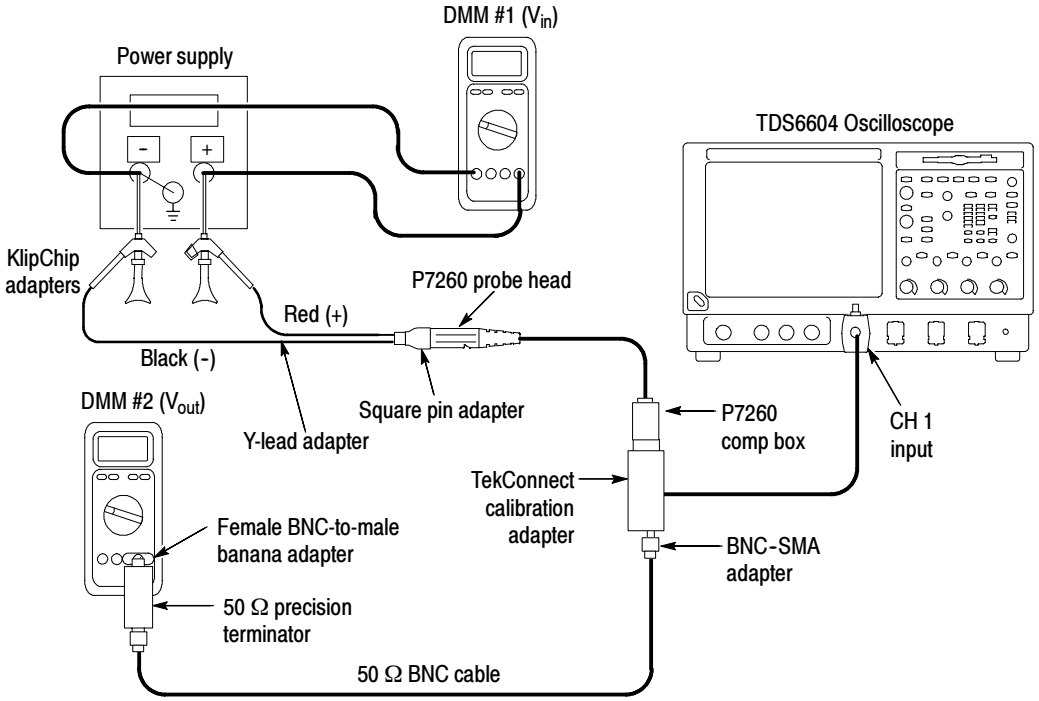


Figure 7: DC Gain Accuracy setup

2. Repeat the steps 3 through 8 at each attenuation setting (5X and 25X).

***NOTE**. To change attenuation settings while performing verification checks, use the radio buttons on the* TekConnect Performance Verification *dialog box (see page 10 for instructions).*

3. Set the input voltage on the DC source to approximately +0.5 V. Record the actual voltage (measured on DMM #1) as $V_{in}1$.
4. Record the output voltage (as measured on DMM #2) as $V_{out}1$.
5. Set the input voltage on the DC source to approximately –0.5 V. Record the actual voltage (measured on DMM #1) as $V_{in}2$.

6. Record the output voltage (measured on DMM #2) as $V_{out}2$.
7. Calculate the gain as follows: $(V_{out}1 - V_{out}2) \div (V_{in}1 - V_{in}2)$.
8. Verify that the gain is:
   a. 0.2 ± 2%, for the 5X attenuation setting
   b. 0.04 ± 4%, for the 25X attenuation setting

   Record the results on the test record.

***NOTE**. An unacceptable error value may result if a low tolerance termination is substituted for the recommended termination.*

Rise Time

This procedure verifies that the probe meets rise time specifications.

The probe rise time is calculated using rise times measured from the test system separately, and the test system including the probe.

Test System Only

1. Connect the test equipment as shown in Figure 8, below. The TDS6604 oscilloscope is only used to power the TekConnect adapter and probe. All settings that follow apply to the CSA8000/TDS8000.

CAUTION. *To prevent damage, use care when working with SMA connectors: support equipment to avoid mechanical strain on the connectors, and use a torque wrench when tightening connections.*

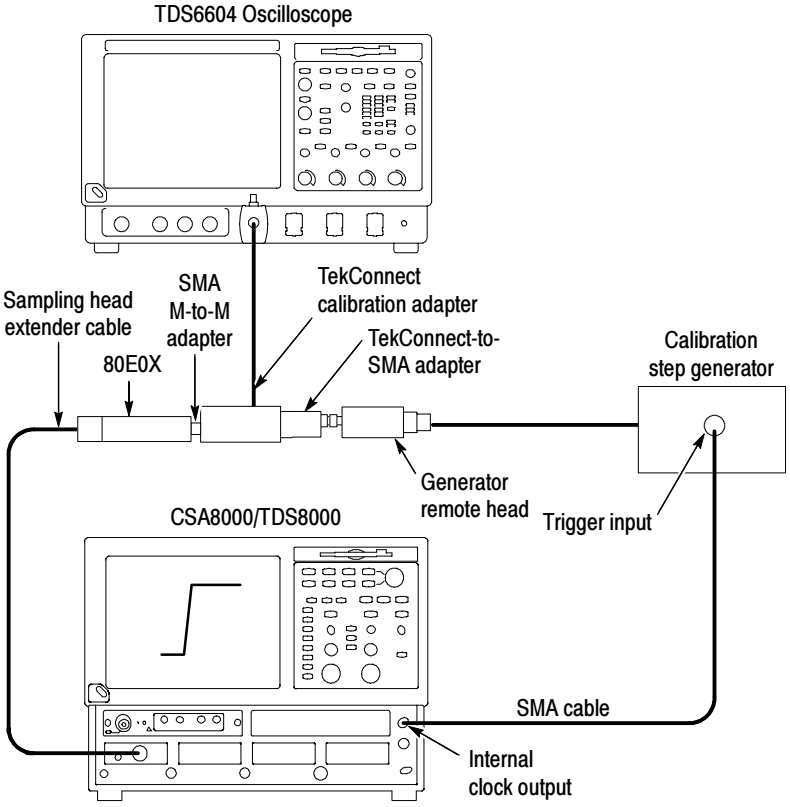


Figure 8: Test system rise time setup

2. Set the oscilloscope trigger to internal clock.
3. Select the channel you have connected to on the 80E0X sampling head, and then set the oscilloscope vertical scale to 50 mV/division.

***NOTE**. The output of the step generator rises from a –250 mV level to ground.*

4. Adjust the oscilloscope horizontal and vertical position controls to display a signal similar to that shown in Figure 8 on page 14.
5. Set the oscilloscope horizontal scale to 50 ps/div and center the waveform.
6. Use the oscilloscope measurement capability to display rise time. Increase the stability of the pulse edge measurement by using averaging, if available. Rise time is determined from the 10% and 90% amplitude points on the waveform. Record the rise time as t_s.

The system rise time (t_s) that you measured in step 6 represents the rise time of the test system without the probe.

Test System with Probe

After you assemble the test setup that includes the probe, as shown in Figure 9 on page 16, you will measure the system and probe rise time (t_{s+p}) in step 8. This is used to calculate the probe rise time (t_p) in step 9.

1. Set the step generator control switch to standby.
2. Remove the TekConnect-SMA adapter from the test setup.
3. Connect the test setup as shown in Figure 9 on page 16.

***CAUTION.** To prevent damaging the SMA connectors, use a 7/32-inch wrench when connecting and disconnecting the female-to-female SMA adapter.*

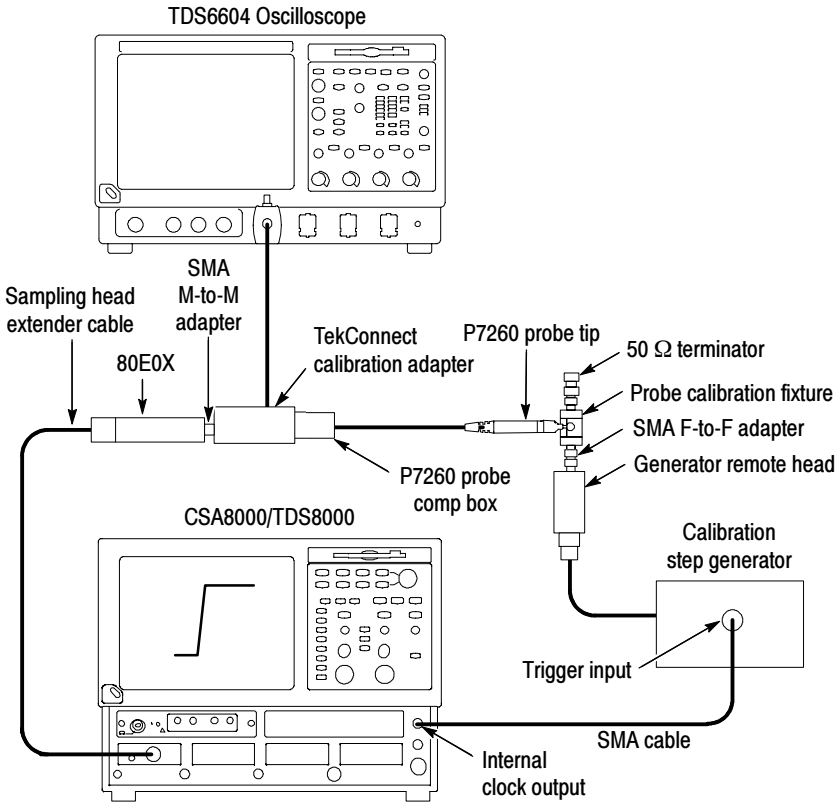


Figure 9: Test system and probe rise time setup

4. Set the step generator control switch to on.

5. Repeat the steps 6 through 11 at each attenuation setting (5X and 25X).

NOTE*. To change attenuation settings while performing verification checks, use the* TekConnect Performance Verification *application (see page 10 for instructions).*

6. On the TDS8000, expand the horizontal scale to locate the step edge:

a. Set the vertical scale to
- 10 mV/division for the probe set to 5X attention
- 2 mV/division for the probe set to 25 attention

b. Adjust horizontal range to 100 ps/division while maintaining the edge view.

c. For a more stable measurement display, turn averaging on.

7. Adjust the TDS8000 horizontal and vertical position controls to display a signal similar to that shown in Figure 9 on page 16.

NOTE. *Do not touch the probe tip adapter when making calibration measurements. Measurement accuracy is degraded when the probe tip adapter is handled.*

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8. Use the TDS8000 measurement capability to display rise time. Rise time is determined from the 10% and 90% amplitude points on the waveform. Record the rise time as t_{s+p}.

9. Calculate the probe-only rise time using the following formula:

$$t_p = \sqrt{t_{(s+p)}^{\ 2} - t_s^{\ 2}}$$

10. Check that the calculated rise time meets the probe specification. The rise time (t_p) must be:

    a. $\leq$ 75 ps for the 5X attenuation setting.

    b. $\leq$ 85 ps for the 25X attenuation setting.

11. Record the results on the test record.

Test record

Probe Model: _____

Serial Number: _____

Certificate Number: _____

Temperature: _____

RH %: _____

Date of Calibration: _____

Technician: _____

Performance test	Minimum	Incoming	Outgoing	Maximum
Output zero voltage at 5X (± 10 mV error) (at probe output) ± 10 mV (20 °C to 30 °C)	- 10 mV	_____	_____	+ 10 mV
Output zero voltage at 25X (± 10 mV error) (at probe output) ± 10 mV (20 °C to 30 °C)	- 10 mV	_____	_____	+ 10 mV
DC Gain attenuation accuracy at 5X (≤2 % error)	196 mV	_____	_____	204 mV
DC Gain attenuation accuracy at 25X (≤4 % error)	38.4 mV	_____	_____	41.6 mV
Rise time at 5X (% error)	N/A	_____	_____	≤75 ps
Rise time at 25X (% error)	N/A	_____	_____	≤85 ps